NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3550 MIDTERM EXAM II 11/99 Prof. Powers

- This exam is closed book and notes; notes on four sides of 8-1/2 x 11 paper are allowed.
- There is a 50 minute time limit.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be *sure* to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.

1	
2	
3	
Total	

Name: _____

1. Consider connectors that are to join two step-index, single-mode fibers operating at 1550 nm. The connectors are of the "PC" (i.e., "physical contact") type. Both fibers have an n_1 of 1.456 and a Δ of 0.5%. The mode-field diameter of the emitting fiber is 8 μm and the mode-field diameter of the receiving fiber is 9 μm. Find the maximum allowed lateral displacement in the connectors if the total connector loss is not to exceed 0.5 dB and the angular misalignment is negligible.

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2. Consider a laser diode operating at 1330 nm. It has a threshold current of 80 mA at an operating temperature of 400K and a threshold current of 110 mA at an operating temperature of 420K. The external quantum efficiency of the laser at room temperature (300K) is 0.012. Find the output power from the laser diode at room temperature when the drive current is 100 mA.

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3. A 3x3 coupler, an optical circulator, and a Bragg grating are interconnected as shown in Fig. 1. The components are all made of 50/125 fiber. The loss matrices for the coupler and circulator are given in Tables 1 and 2. The (idealized) reflectivity of the grating is plotted vs. wavelength in Fig. 2. The losses of each splice is 0.2 dB; all fiber losses are negligible.

   If we have 600 μW of power at 1550 nm in the fiber at point "A", calculate the power at point "B" in Fig. 1 in dBm *and* μW. (Note: You *must* use the "dB method".)

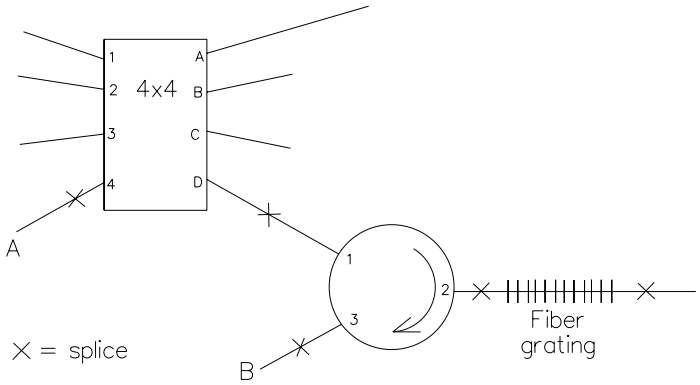

Figure 1: Component connection for Problem 3.

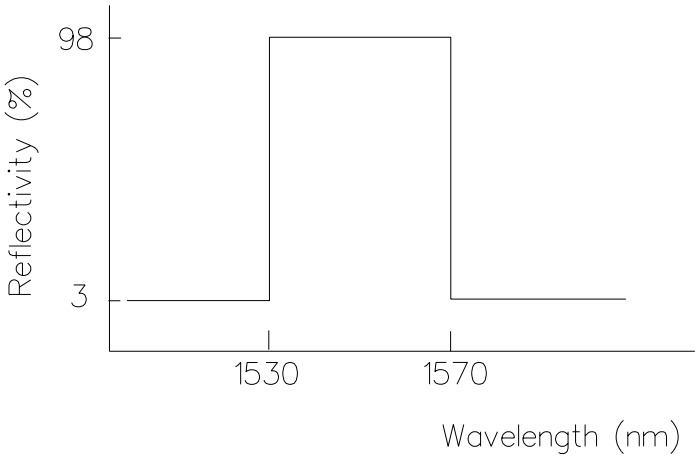

Figure 2: Reflectivity vs. wavelength for fiber grating of Problem 3.(idealized).

	Output			
	A	B	C	D
1	6.5	6.6	6.4	6.8
2	6.4	6.5	6.6	6.8
3	6.8	6.5	6.4	6.7
4	6.7	6.4	6.5	6.4

Table 1: Measured loss matrix for 4x4 splitter of Problem 3. The inputs are on the left; the outputs are across the top.

	Output		
	1	2	3
1	—	0.5	50
2	51	—	0.6
3	0.7	55	—

Table 2: Measured loss matrix for optical circulator of Problem 3. The inputs are on the left; the outputs are across the top.